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Business Domain
Media & Publishing

Project Type
Data Processing

Intetics Created a Machine Learning Algorithm That Recognizes Human Emotions To Improve Wearables for Sports Fans

Client

The Client is a UK-based wearables development company.

Project

Enriching the product with an emotional-response feature.

Objective

To develop a machine learning algorithm for emotion recognition and find correlations between biosensor data and emotional events.

Team Reinforcement

To successfully implement the feature the Client needed a team of experts to build the machine learning algorithm for emotions recognition. The Client approached Intetics with the request to fulfill the task within a strict time span.

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Challenge

The Client is a UK-based wearables development company that was launching a wearable for sports fans.

The Client decided to enrich the product with an emotional-response feature and needed a team of experts to develop a machine learning algorithm for emotion recognition.

The Client carried out research and gathered data from different biometric sensors, worn by fans during live events, and also came up with suggested emotional responses. They delegated Intetics to develop the ML algorithm and the feature.

Quick Facts

- Valence of an emotion and the arousal level are recognized
- The model is edge-computing ready and optimized for wearables
- As a result of Intetics' research, the hardware cost was optimized

Technologies

GNU Octave / C# / .NET

Solution

★ 01

The Client's wearable device for sports fans proves that the recognition of emotions from the data of biosensors is possible and works. The consumers can now use the feature to share their emotional reactions to sports events.

★ 02

- Having biosensor data and time-coded reactions to the events, Intetics decided to apply a supervised machine learning approach when creating the algorithm.
- Before developing the algorithm, Intetics implemented a visual tool for biosensor data labeling. Using the correct labels is critical for supervising machine learning issues. In that context, labels corresponded with time intervals in which any intense emotions were expected. The biosensor data of each fan was labeled individually based on XML timecoded feeds, video recordings of games, and fans' physical reactions. Using the visual tool, an operator was able to quickly and efficiently make the labels.

★ 03

The preprocessing of the data was the first step of the algorithm. This included data filtering and removal of some artifacts. Along with that, each filter introduced a delay in the data, called a "group delay." This means that the output filter data was a bit shifted against the input data (i.e., slightly delayed). Each filter had its own group delay. These delays need to be considered because misaligned time data may cause low results of recognition, even if the rest of the algorithm is perfect. After all of these actions, the output of each sensor was normalized and fit the range from 0 to 1.

★ 04

The second step included extracting features and performing segmentation. Segmentation meant that all data from each sensor, processed at step one, was presented in short pieces of time, usually from 1 to 3 seconds. The feature extraction process included calculating the values for each time segment and sensor.

★ 05

The third step was about dimensionality reduction. After the first and second step, the Intetics team had a large volume of data.

★ 06

The fourth step was related to data splitting for training and testing purposes. That step required specific algorithms. The data was split into two parts. 70% of it was used for training while 30% was for testing.

★ 07

Training was the fifth step. To train the algorithm, the Intetics team used 70% of collected data and relevant labels to teach the algorithm which time segments were emotional and what type of emotion they related. Following this approach, the algorithm remembered segments that were characterized by emotions.

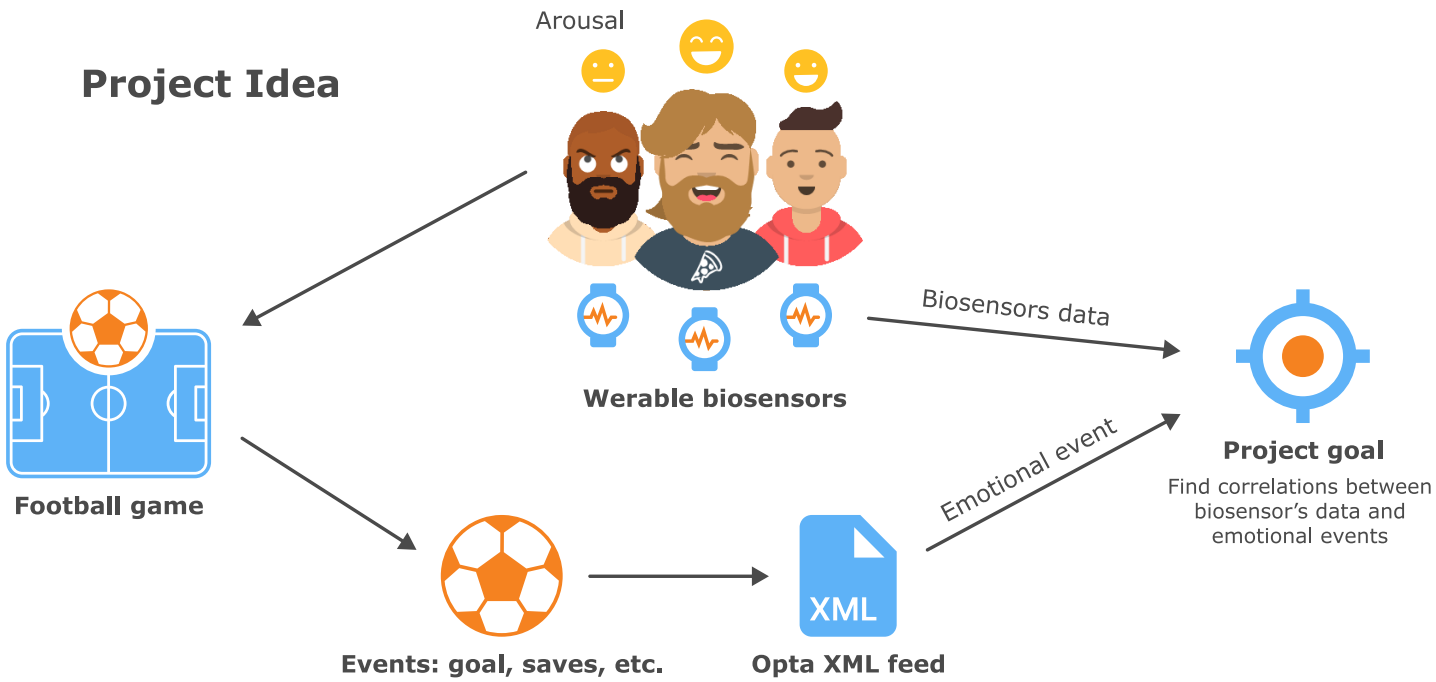
★ 08

The testing of classification was the last step. The trained algorithm used the remaining 30% of data. During the testing process, the algorithm estimated each segment and made decisions.

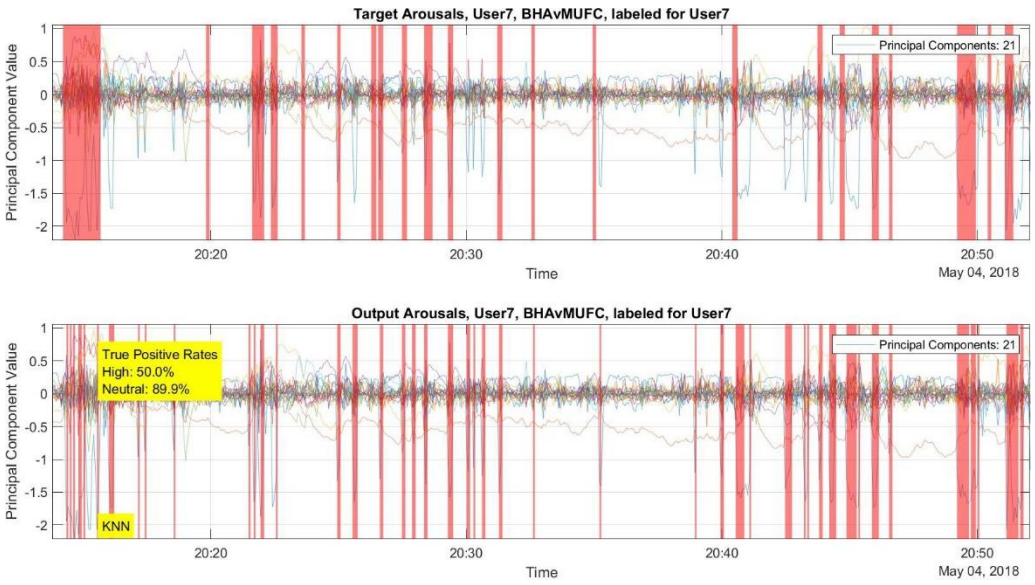
Often in the real world, algorithm training and all previous relevant steps are performed offline, before uploading firmware into the device. Classification and all relevant steps from the first one are performed in real-time on the device.

★ 09

During this research, Intetics found the most revealing metrics for emotion recognition. This allowed us to optimize the hardware cost by including only the necessary sensors.



An example of classification results, time domain



Client Reference

“Together with Intetics, we’ve not only developed a wearable device with the embedded emotion recognition feature but also proved that such features is possible based on biosensor data. Our work may become a significant contribution in the niche and find more application across different niches.

CTO

Benefits and Results

- The Client managed to implement the algorithm that confirmed that the recognition of emotions from the data of biosensors is possible and works.
- Sports fans can now share their emotional reactions to sports events via wearables.
- The algorithm allowed to add the innovative feature to the product and thus boost customer loyalty to the product.
- Intetics delivered the solution in time, regardless of the short timeframe.

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